Great Salt Lake Panel Coordination Meeting

ATTENDEES:	Bill Adams	Harry Ohlendorf
	Don Hayes	Earl Byron
	Bill Wuerthele	Gary Santolo
	Anne Fairbrother	Bill Johnson
	Theresa Presser	Dave Naftz
	Theron Miller	Mike Conover
	Joe Skorupa (by phone)	John Cavitt
	Brad Marden (by phone)	Jeff DenBleyker
	Bill Moellmer (by phone)	
AUDIENCE:	Kimberly Beisner	Ying-Ying Macauley
	Wade Oliver	Leland Myers
	Ximena Diaz	Nathan Darnall
	Bruce Waddell	Kelly Payne
	Maunsel Pearce	Joy Emory
	Chris Montague	Lynn de Freitas
	Mark Atencio	
COPIES:	Division of Water Quality	
FROM:	Jeff DenBleyker, Ying-Ying Macauley	
DATE:	November 28 & 29, 2007	

Wednesday, November 28, 2007

Review of Project 3 Results – Selenium Loads

Dave Naftz

Please see slides from presentation. Key points are as follows:

1. Continued flow measurement and sampling at six locations.
2. Collected shoreline sediment samples along transects near Great Salt Lake (GSL) Minerals and Saltair. Estimated selenium (Se) load from lake rise in November 2006 through April 2007 is 10 kilograms (kg).
3. Trend was that load decreased over study period. Runoff in 2006 was higher than in 2007, thus Se load decreased in 2007. The 2007 water year was very dry.
4. Annual Se load from tributaries from May 2006 through April 2007 was 1,480 kg.
5. Goggin Drain, Bear River, and Kennecott Utah Copper (KUCC) outfall were the top three load sources.
6. Flux to the North Arm is very dynamic; have only five grab samples and flow measurements. We know that there is a head differential between North Arm and

South Arm indicating that flow generally is to the North Arm. It is very difficult to estimate flow through three culverts and through the causeway. Estimated load was 880 kg per year (kg/yr); uncertainty of this number must be acknowledged.

7. Open water concentration increased over the study period; increase in dissolved Se was less at sites with deep water and deep brine layer. Analytical noise does not explain this difference.
8. Comparison of the open-water concentration with load input shows that there is perhaps an unaccounted-for Se load; alternatively, there may be processes in the lake that we are not aware of.
9. Dave estimates a 15-month deficit of 1,500 kg. Possible explanations are as follows:
    - Submarine groundwater discharges to the GSL. Initial resistivity analysis completed by U.S. Geological Survey (USGS) indicates there may be a groundwater input near Saltair along a fault scarp. Dave pointed out that a KUCC 1999 study identified a Se plume at KUCC smelter. Is this flowing into the GSL?
    - Atmospheric deposition. Dave pointed out that the lake had a surface area of 700 square miles (mi^2), while the lakes watershed has an area of about 12,550 mi^2.
    - Lake sediment pore water diffusion.
    - Unmeasured surface inflows. Estimate of additional flows from Weber River could add an additional 46 kg for study period.
    - Evaporative concentration of Se in water.
10. Key questions to ask: 1)Why did lake concentration increase?, 2) Will lake concentration continue to increase?, 3) What is flux to North Arm?, 4) What is the source of unmeasured Se?

Discussion:

1. Should look at Brad Marden's water data along with Dave's lake water data to see if there is a similar trend.
2. The increase in lake concentration does not seem to match the current mass balance indicating a net loss of Se from the water column. The difference represents an increase of approximately 0.34 ug/L over the year. If Se was conservative, the tributary loads would increase the lake concentration by only 0.17 ug/L.
3. Bill Adams pointed out that his measurements of lake concentration in 2002 (0.62 ug/L), 2004 (0.78 ug/L), and 2005 (0.58 ug/L) show the lake concentration varies over time and has been higher than during study period. His samples were collected in June of each year and filtered in lab.
4. Don Hayes asked what the potential load contribution is from the proposed JVWCD RO concentrate discharge. Jeff DenBleyker pointed to a presentation JVWCD gave to the steering committee in 2004 where that load was estimated at 37 kg/year. Don pointed out that that number helps keep what we are trying to do in context.
5. Does lake receding add a load from potential storm runoff? Not likely as the load is only 10 kg if lake level increases and inundates the shoreline.
6. Is there a disequilibrium function that we don't know about?

7. Bill Adams will look into the status of the KUCC Se plume. Source of Se plume had been previously removed.
8. Is there a trend in tributary concentration that matches the lake concentration?
9. Would be beneficial to look at flow records and try to match that with Se concentration data to try to reconstruction historic Se loads.

Review of Project 4 Results – Selenium Flux

Bill Johnson

Please see slides from presentation. Key points are as follows:

1. The GSL matrix is very complicated, which makes it very difficult to speciate.
2. The GSL's shallow layer is well mixed.
3. Se concentration does not vary much between shallow layer and deep brine layer.
4. Particulates are significant in the water column.
5. The University of Utah (U of U) was able to implement flow fractionation for many trace metals but not for Se.
6. Estimated permanent burial of sediment to 250 kg/yr (geomean) with range of 150 to 500 kg.
7. One point at north end of lake had a very high sedimentation rate; however, this is likely an artifact of causeway construction. Developed sedimentation estimate from many shallow cores, geophysical data, and deep cores. Developed weighted average, with good confidence in this estimate.
8. Observed an increase in volatile Se in the first 6 months, but lowered in deep brine layer. Volatile Se levels very dynamic. Lower in winter and higher in summer. Fit a sinusoidal trend to the geomean and geometric standard deviation. Volatilization flux estimated at 1680 kg/yr, with range of 245 to 14,500 kg.
9. Some scatter between predicted and measured volatilization flux, but OK given the variables. They are working to see if trapped helium in the flux chamber may have caused some of the scatter. No correction at this point.
10. Variability for permanent sedimentation is a factor of 2. Variability for volatilization has a factor of 6.
11. Theron Miller indicated that this is to be expected. He felt that given the variables and dynamic condition on the lake, this was as good of an estimate as could be achieved at this time.
12. Still have a discrepancy between load, lake concentration, and flux. Mass balance indicates a net loss of Se from the water column: however lake concentration is increasing. Bill illustrated plot of lake concentration for a conserved tributary load and with volatilization and sedimentation to illustrate that even a conserved tributary load does not explain the lake concentration.
13. Bill Johnson thinks that volatilization rate is on the low end of the range. He estimated 500 to 1000 kg.
14. Potential sources? Bill is looking into a potential contribution from sediment when the deep brine layer recedes as it has done this year. They have estimated that 1 percent of the Se in anoxic sediment solubilizes when sediment becomes oxic.

Review of Mass Balance Model
Earl Byron

Please see slides from presentation. Key points are as follows:

1. Earl defined primary load and flux components of model. Tributary loading and volatilization are the most important processes.
2. Mass balance accounts for Se mass in lake water column and adds difference between gains and losses to estimate a new lake concentration. Model operates on a quarterly time step and accounts for quarterly lake volume changes. Model accounts for only one 12-month period: July 2006 through June 2007.
3. Earl added feedback loops to account for some of the internal process of the lake.
    - Volatile Se levels were linked to total Se concentrations to reflect that volatilization likely increases if the lake Se concentration goes up. Bill Johnson pointed out that there is no data that indicates that there is any relationship between volatile Se and total Se concentrations. Volatile Se is highly variable by orders of magnitude. Total Se only varies by a factor of 2. Bill Johnson agreed that Earl's link is harmless but we just do not have the information to back it up.
    - Earl described another feedback loop that accounts for remineralization. Earl subtracted falling Se particles from the permanent sedimentation flux to describe feedback into the system. Bill Johnson pointed out that this load is already measured by Dave's load estimates. Discussion concluded that a distinction needs to be made between dissolved and total Se concentrations in the model.
4. Model currently describes steady-state condition; have monthly, quarterly, and annual estimates for many of the variables. Used simple ratios or regressions to describe transfer of Se between water/sediment and food web. Currently using Martin Grosell's relationship for brine shrimp. Foodweb is similarly linked to avian trophic levels.
5. As a check on the model developed for one year of data and to make an attempt at understanding the context of the model with regard to future changes, Earl added an element to the model that allowed the model to continue to estimate lake concentrations for a period of 10 years based upon quarterly time steps. User can apply a multiplier to the tributary load as part of a sensitivity analysis.

Discussion:

1. Dave Naftz pointed out that the model should incorporate the spring runoff from 2006. Earl's model currently does not include it and may result in missing an important process. Earl will look at adding that to the model so that it captures 15 months instead of 12.
2. The model should try to link permanent sedimentation to loads.
3. The model should not include the sediment dissolution term.
4. The model should allow the user to vary the proportion volatilization changes with lake concentration level.

5. Joe Skorupa pointed out that qualitatively, the biotic side is controlled by the dynamics of organo-selenium. The Se load could be decreased to the lake but it could take awhile for the organo-selenium to decrease.
6. Bill Adams suggested that the GSL system could react quicker than fresh water. There are many processes in the GSL that we have not observed in fresh water systems.
7. There was much discussion as to the hazards of extrapolating from only 1 year of data. Many Panel members expressed concern about doing so. The current mass balance model is a static model based upon 1 year of data. The consensus was that a fully dynamic, 3-D model is needed to capture the dynamics of the GSL. The 10-year projection should not be used.

Mass Balance Discussion – Afternoon

Jeff DenBleyker summarized discussion regarding the mass balance model. Namely, we have one year of data for an extremely dynamic lake for which many processes are not fully understood. The objective of the mass balance model is to characterize inputs and outputs from the lake to predict a lake water concentration. The ability to predict a lake water concentration is needed to review and set permit limits but is not needed to establish a water quality standard. The water quality standard is determined from the effects of a given lake water concentration upon the critical endpoints in the biotic model. Jeff proposed to separate the two models. Work would continue on both models; however, priority would be given to finalizing the bioaccumulation model used to develop the water quality standard.

Jeff led the Panel in a discussion that listed the factors that we know about the mass balance of the lake and those factors that will require additional evaluation. Those factors are as follows:

What we know

1. July 2006 through June 2007 was a dry period; the previous year was a wetter year.
2. We have good inflow and Se loads from the tributaries that were measured.
3. Volatilization is an important Se loss process.
4. Volatilization estimates are good given methods/objectives; high variability is inherent to estimating this process.
5. Permanent sedimentation rate estimates are good.
6. We know that we are missing Se load (i.e., we do not have a balance).
7. There are processes we do not understand.
8. This is a very dynamic system, possibly a multi-year cycle.
9. Mass balance model is not required to set a water quality standard, but will be needed for permits.
10. Standing mass of Se in lake water column during study period can be estimated.

Items that need additional evaluation

1. What is the relationship between water concentration and volatilization?
2. What is the submarine groundwater contribution?

3. What is the dry and wet atmospheric deposition rate? Literature values are from east coast and may not be applicable.
4. What is the flux to the North Arm? This is a high priority.
5. Look at all water column data as a whole to characterize annual variation, and assess comparability.
6. What is the lake sediment pore water contribution?
7. What is the contribution from other surface inflows?
8. Develop a dynamic, 3-D model of GSL—work off of USGS model.
9. Differentiate dissolved versus total load from tributaries.
10. Estimate contribution from anoxic sediment when DBL shrinks.
11. Define uncertainty behind load estimates from shore sediment rewetting.
12. Break up lake concentrations versus tributary loading over more than one runoff cycle; look at dry year versus wet year.
13. How quickly does Se concentration respond to load fluctuations and can we use mass balance to answer that?
14. Expand constituent list for water sampling to provide additional insight in Se cycling.
15. How does lake level affect Se cycling processes?
16. List unknown sources.
17. Continued flow monitoring.
18. Response time of lake concentration versus load, accounting for changing lake volume.

The Panel agreed that the current model should be separated into two separate models: mass balance model and bioaccumulation model. Focus would be placed upon the bioaccumulation model.

Review of Project 1 Results – Gulls and Overwintering Birds

Mike Conover

Please see slides from presentation. Key points are as follows:

California Gulls

1. California Gulls were observed to have higher Se concentrations at the Great Salt Lake Minerals (GSLM) sampling site than at Hat Island or Antelope Island.
2. Se in blood and liver were highly correlated.
3. No relationship was observed between Se and body mass.
4. Se concentration in blood at freshwater site (Neponset Reservoir) was not different from GSL sites.
5. Mercury (Hg) concentrations were observed to be lower at Neponset Reservoir than at GSL sites.
6. No effects were observed in eggs, which had high fertility.

Eared Grebes

7. Eared grebes were collected in September and November 2007 near Fremont and Stansbury Islands; birds do not move around a lot because of molting.
8. Birds were observed to gain Se and Hg with time.
9. Higher Se and Hg concentrations observed in birds collected near Stansbury Island.
10. There is a relationship between blood Se concentrations and liver Se concentrations as well as blood Hg concentrations.
11. Se and Hg were highly correlated.

Goldeneyes

12. An adequate number of goldeneyes could not be collected in early 2007. Birds collected the previous winter (November 2005 through March 2006) were used.
13. Higher Se and Hg concentrations observed in birds collected near Stansbury Island than near Fremont Island. That may point to fact birds are accumulating Se and Hg from the GSL.
14. Se was correlated to Hg and liver concentrations to blood concentrations.
15. No relationship was observed between Se and body mass.
16. Goldeneye diet varied extensively with temperature and some portion of diet was consistently not from the open waters of the GSL. Seem to favor shallow wetlands (seeds) away from open waters of GSL but as temperature drops and ice forms, the birds move to the open waters of the GSL. They then seem to favor brine fly larvae until they are not available. Will eat artemia cysts if they need to. Will eat 50 percent fly larvae when warm and 100 percent when cold.
17. Body mass does decrease as season progresses but difficult to correlate as we do not know when each bird arrived at the GSL. Very transient bird; moves around the lake a lot.

Discussion:

1. Grebes are localized as they cannot fly while on the GSL. The physiology of the eared grebe complicates the creation of a body condition index. Body characteristics of eared grebes fluctuate significantly in the weeks while on GSL. Very difficult to compare birds depending upon their stage in body changes while on the lake.
2. Gulls and goldeneyes can move a lot. Gull will not fly far while nesting. Goldeneyes seem to move a lot.

Review of Project 1 Results – Shorebirds

John Cavitt

Dr. Cavitt verbally summarized the key results contained in his reports. All figures referenced are in the draft reports.

Joe Skorupa requested that John provide additional egg data in the appendix. John agreed.

Review of Avian Model

Gary Santolo

Please see slides from presentation. Key points are as follows:

1. Avian model uses output from Foodweb model to estimate Se concentrations in bird diet, blood, liver, and egg. Data from Cavitt and Conover provide the basis for transfer factors and regressions.
2. Specific diet compositions were identified for each bird species studied. Se concentrations for each food item type were determined. Diets can be weighted by the user depending on bird species and desired diet composition.
3. Transfer factors were developed to relate bird diet to blood, liver, and egg concentrations.
4. A regression model was developed to describe the transfer of Se from diet to egg for gulls and shorebirds. Limited co-located sampling—four locations to work with for gulls and shorebirds. Each regression developed from a geometric mean developed for each of the four locations (i.e., four data points for each regression model).
5. Gull regression model is not adequate. R^2 of 0.001.
6. Shorebird regression model is much better but still not much data. R^2 of 0.785. This regression model was compared against a regression model of mallard diet and egg using data summarized in Ohlendorf 2003. This model was based upon a much larger data set but represents a species more sensitive to Se than shorebirds on the GSL. The shorebird and mallard regression models have a very similar slope thereby lending confidence to the shorebird model. Gary recommended that the shorebird model be used because the mallard model was based upon lab data.
7. Gary developed a liver index for eared grebes using a Heinz threshold for liver Se concentration of 10 parts per million (ppm). Gary evaluated the available dataset but could not find any other indices to use.
8. Gary developed a fat index for goldeneyes. Gary evaluated the available dataset but could not find any other indices to use.

Discussion:

1. Joe Skorupa pointed out that the shorebird model predicts egg concentrations less than 1.0 ppm at 10 years. That represents a deficient concentration and is not realistic. It was agreed that the 10-year projection should not be used. It was suggested that we use the mallard model exclusively.
2. It was pointed out that the mallard model predicts too high of an egg value; need to use the shorebird model as it is site-specific to the GSL and reflects actual GSL concentrations. The Panel agreed that the shorebird model should be used for all species. The mallard model will not be used as it is not site-specific, is based upon a species that is more sensitive to Se, and using selenomethionine in the diet rather than bioaccumulated Se from a natural diet.
3. Gary suggested that the body condition indices need further work. Need to try to look at the rate of gain for these birds.
4. It is very difficult to relate Se to body condition of eared grebes because they are so unusual. Their body condition varies depending on point in migration cycle (specifically, the changes in their bodies while on the lake). Perhaps we cannot evaluate eared grebes for non-breeding effects because of the following:

- Variable body condition
- Possible interactions between Se and Hg (cannot isolate effects from Se)
- Se in blood and livers on the GSL has been acknowledged to be higher than elsewhere and indices relating Se concentrations in blood and liver are not valid on the GSL

5. The Panel agreed to remove the eared grebes from consideration.
6. Need to look closely at goldeneyes. Specifically look at bill nail, toe nail, and atrophy of spleen. Some literature that correlates spleen to Se.
7. Can we use the goldeneyes to evaluate non-breeding effects if they feed all over? The goldeneyes also have high Se and Hg in blood and liver, there are possible interactions between Se and Hg (cannot isolate effects from Se), their diet indicates they may feed extensively away from the open waters of the GSL, and the arrival time for the birds sampled is unknown.
8. What is a reasonable fat index for goldeneyes? We can not answer that question.
9. How can we measure body condition in overwintering birds? We need a reference body condition for goldeneyes and eared grebes.
10. Joe Skorupa pointed out that Heinz 1996 identified a non-breeding effect guideline for dietary exposure of 10 ppm Se dw. That level is based partly on the reported winter stress syndrome, when cold stress increased the effect of Se on mallards in a laboratory study in Maryland. Perhaps that should be used as our fallback.
11. Factors that confound the use of goldeneyes for evaluating non-breeding effects of Se:
    - Elevated Se and Hg in blood and liver, increases while on GSL
    - Do not understand interaction between Hg and Se
    - Diet is very mixed, open water and wetlands
    - Birds move around a lot
    - Arrival times for birds are unknown
    - No not have reliable index or threshold for effects for anything
12. What we have does not allow us to assess risk or support the urgent need to assess non-breeding effects—important to note that this remains an open question.
13. Gary was asked to complete the following and report to the Panel the next day:
    - Look at gull regression model to see if removal of an outlying point would improve the model and then compare to the shorebird and mallard models
    - Look at goldeneye spleen data to investigate whether or not a new body condition index could be developed
14. Bill Adams asked that Brad Marden's presentation on his project's results be delayed until 11:00am the next day.

Thursday, November 29, 2007

Review of Discussion from Previous Day

Jeff DenBleyker

Jeff presented slides he developed that summarized the previous day's discussion regarding the mass balance model. See slides. Key points of discussion are as follows:

1. The use of the words "good estimate" was questioned when the estimated variability for volatilization represents a factor of 6. Don Hayes stated that it is important to note that it is a 1-year estimate and the estimate is as good as we could get.
2. Clear and accurate communication of the variability and usefulness of results will be essential. It was suggested to present the information in a table format that defines the suggested value, its variability, and how comfortable the Panel is with this number. Dave Naftz suggested using a color code (green, yellow, red) to indicate the Panel's level of confidence for each value.
3. Jeff asked the Panel to confirm action items for each of the components in the mass balance model. They are as follows:
    - Deep brine layer contribution—Bill Johnson is estimating this value
    - Take out the particle dissolution term because it is "double counting" this "input;" however, it was noted that the model is treating this as a source back into the water column (which is what that part of the model represents), not loading to the whole lake.
    - Use an average of values found in literature for atmospheric deposition
    - Add 46 kg to tributary load to account for missing Weber River flows
    - Use 10 kg for shoreline rewetting
    - Loss to North Arm could vary 0 to 1,600 kg.
4. Theresa asked that sediment be added to the EC curve tab in the model.
5. Joe pointed out that we need to have a reason and justification if we are not going to use geometric mean values of volatilization results as we do with other values.
6. Harry and Joe discussed the methods used to study Se volatilization at the Chevron Richmond Refinery treatment wetland by Norm Terry. Earl said issues such as the influence of wind, temperature, surface roughness, etc., are not accounted for in the chamber used at the Chevron wetland. Joe said that Norm Terry found that the salt water systems are very different from marsh systems. Jeff asked that Harry and Joe provide those references to Bill Johnson. Joe suggested having those researchers (Norm, etc.) review Bill Johnson's work and get their feedback.
7. Ann said that the mass balance model needs to be refined to be able to predict the future for the purpose of permit evaluation and implementation. Jeff said that would need long-term database to accomplish that goal.
8. Bill W. asked whether we have any idea of the magnitude of anthropogenic load into the GSL system in addition to the natural tributaries. The actual, historical anthropogenic load will be difficult to estimate given long-term influences in watershed.

9. Don said the mass balance model is not perfect but still can be used with known limitations; no need to throw it out; further work needs to be done. Theron identified two outstanding issues that need to be resolved: one is the North Arm transfer (in and out flux), the other is the volatilization. Don said, instead waiting for another 12 months of study on those two issues, he would rather focus on looking at the tributaries data and see how to extrapolate the data to go beyond 1 year. Don said the problem with the mass balance model is that this is such as a dry year and resulted in such a deficit. Dave N. said the sediment core samples can supplement the hydrological trajectory study. Bill M. said it is important to understand that this project will come to a conclusion; the Panel is to give the best shot based on what we know and to make the recommendation to the Steering Committee; it is OK to identify future needs for scientific research, but we need to focus on coming to a conclusion.
10. Earl said that we know we have good water column Se measurements over the 15 months; what is not included in the mass balance model now is the delayed response between Se load increase in tributaries and the increased Se concentration in the lake; it is not a 1-to-1 ratio, and is not an immediate response.
11. Bruce Waddell asked about Se load change due to the cyst removal and the bird migration. Harry said we do not have data describing whole body Se concentrations in birds. This is very difficult to predict as we do not know how much Se they retain and how much they excrete. Quantification of the amount of Se birds export via body mass would require careful measurement of Se when the birds arrive and when they leave.
12. Don suggested summarizing the conclusion of the mass balance study. The concern is the trend we are observing. We can use the mass balance model with some qualifications but focus on the avian study and biotic model.
13. Ann suggested that we order the Steering Committee presentation to first focus on what is needed to develop the standard and then talk about the mass balance model. The Panel's charge is to develop a water quality standard.

Update on Avian Model

Gary Santolo presented the results of his analysis of data from the night before.

1. Gary illustrated that while removing one outlying data point in the gull dataset improved the regression, it reduced the number of data points from 4 to 3. All agreed that the gull regression model was not good and should not be used.
2. Gary reiterated that we would use the shorebird model as recommended by Anne because the shorebird data are site-specific and mallards are more sensitive to Se than shorebirds found on GSL. Using the mallard model would be more conservative than the shorebird model but does not represent species on GSL. These two models will provide different perspectives and provide a range to consider. Bill W. is concerned about not using sensitive species such as mallard. Joe said we will still use mallard data for assessing toxicity (EC curves) and use shorebird data to represent Se transfer; we still use both.
3. While presenting the goldeneye fat index data, Gary said that the interaction between Se and Hg makes the GSL data not a good fit; we do the best we can do with the small sample sizes we have, but the interaction is still there; fat index is a better indicator than the weight among various sizes of birds. Harry said adding spatial differences and

seasonal differences may not help. Gary said that there is no indication of Se affecting the body weight of birds. Jeff said another factor is the bird diet; for example, goldeneyes feed in wetlands environment a lot. Anne asked whether there is a threshold fat index that defines bird wellness. Gary said no. The Science Panel agreed that a lot of confounding factors are in the picture.

4. Jeff asked the Panel for feedback on what to do with the avian study: discard goldeneye or look further into the indices, etc. Bill W. said to remove goldeneye data and focus on the shorebirds model. Theresa said she is hesitant to ignore these stressed birds and simply put them aside. We need to acknowledge the stressors. Gary suggested we put the goldeneyes aside because we do not have enough information to make a determination. We need further studies in the future. The Panel questioned whether these birds are stressed. Teresa pointed out that the liver Hg level is high and Se is high. Jeff said we are seeing elevated levels of Hg and Se in liver and blood samples but we have no threshold to judge non-breeding effects. Gary said that these birds use GSL for wintering and move on to their breeding ground. Harry said that Se is known to help birds sequester Hg in the inorganic (less toxic) form in the liver. Joe said that the only caveat is the winter stress syndrome, which lowers the toxicity threshold for birds because of multiple stressors (cold, food, etc.) at the same time; we don't have enough information to use overwintering body condition as an endpoint for development of the water quality standard; we still consider it a very much open question.

Draft Report & Schedule

Jeff asked for the feedback from the Science Panel on the report they received; the Panel can either discuss the comments during the meeting or e-mail to Jeff. Bill W. wants to discuss implementation of the water quality standard; use the word "surveillance" monitoring (not "compliance" monitoring), which will trigger the re-evaluation of the Se standard.

Jeff reviewed the current schedule that includes revising the model and the report based on the Science Panel comments in December. Comments from the Science Panel will be needed within a few weeks. Jeff reported the status of the reports that are expected to come to the Science Panel.

Bill M. would like to keep the current schedule. Leland would like to have adequate time for review and change the schedule if needed. Joe agreed with Bill Adams's request to have until the end of January to complete review. Jeff said this delay would shift the original schedule by 2 months, which results in a recommendation for a standard at the end of April instead of at the end of February. The new schedule includes Science Panel providing all review comments by the end of January 2008, CH2MHill revising the report and the model in the month of February; the Science Panel completing its final review by the end of March; and then having a final Science Panel meeting at the end of April. The Science Panel would have a joint meeting with the Steering Committee after their April meeting. Joe clarified that when he said "complete review" he meant "ready to be reviewed by the Steering Committee," and he didn't mean ready to be released to the public. Don asked for a prioritized list of these reports. Jeff said he would send the Science Panel a list of reports, their status, proposed review priority, and deadlines.

Mark Atencio asked when the reports will be ready for the Steering Committee review. Leland, Maunsel, and Mark all agreed that they would like to have sufficient time to review

prior to having to make a decision. Mark emphasized the importance of having transparency through the process. Allowing the Steering Committee and the public to provide input during the process instead of at the end will prevent the appearance that the decision has already been made. Harry suggested setting up a tracking sheet of review steps, list of report, and status. Ying-Ying suggested posting the table on the Web site and notifying Steering Committee members and stakeholders when the status has been updated. This will help provide transparency.

Review of Project 2B Results – Pelagic Zone

Brad Marden

Please see slides from presentation. Key points are as follows:

1. Artemia population dynamics show a healthy, robust population.
2. Excellent cyst density and good harvest tonnage. On track for high harvest this year.
3. Good Chlorophyll A relationship to Secchi disk measurements. As a rule of thumb, algae/Chlorophyll A are high if Secchi depth is less than 100 centimeters (cm).
4. Algal growth correlates to artemia population cycles.
5. The seston adjustment study was to look at the effect of salt weight (held on the filter paper during sample collection) on the sample weight and resulting Se concentrations for the samples. Brad filtered lake water at different salinities to determine a correction for salts that remained on seston filters. The seston data comparison against Martin Grosell's steady state equation shows good fit.
6. We will use 2007 artemia data for the model. 2006 data will need to be corrected for salts included in the analysis by LET. Correction factor will need to be evaluated.
7. The lake is well mixed based on the Se results (i.e., no spatial trend). Comparing the total Se and dissolved Se shows no time trend (both stayed in the ranges throughout the study period).
8. Brad observed an upward trend in water and seston Se concentrations over the study period.
9. Adult artemia and nauplii have quite different Se concentration (4.3 versus 2.2 micrograms per gram [µg/g]). Brad compared his results to Martin Grosell's results – showed good correlation even though the approaches were different.

Model Discussion

Jeff said that there are many ungauged streams and the unnamed stream accounted for about 10 percent of flow in Dave N. study. Bill Adams would like to list an "unknown source" in the model to capture the unaccounted for sources. Jeff demonstrated a concept for relating variables in the model to the user. The concept included simplified hydrological scenarios (1992 dry year versus 1984 dry year) to relate tributary load ranges along with pie charts of various scenarios.

Bill M. said from the regulator's perspective, if Jordan Valley Water Conservancy District (JVWCD) were to triple the Se load, the regulator needs to be able to predict and to see whether this would trigger or approach the value. Jeff said the user could modify the input to the model, based on one year of data, to see how tripling the volume would affect the

water column concentration. Anne said the model will need to be able to adjust for the lake volume.

Jeff demonstrated how the model users can change the input and generate various concentration curves and visuals.

Bill Adams presented the Brix et al. data and data representing Se concentrations in corixid samples collected in August 2004 from within the KUCC discharge area. The Se discharge was at 27 µg per liter (µ g/L) (selenate discharge) at that time. The data showed an Se average of 6.5 µg/g in the corixids that were exposed for 30 or 40 days. John Cavitt's bird egg Se data showed that eight samples averaged 5.1 µg/g and max 9.2 µg/g. The immature corixids (sampled by Bill A.) don't get up and fly around, they are not very mobile. We don't see the huge accumulation in corixids predicted by the model. Martin Grosell's data on tissue increase of brine shrimp show water column Se concentration of 0.3 ppm (300 µg/L) and the diet conc. of 0.05 ppm (short-term exposure, low water, and diet exposure). Bill A. mentioned that a 24-hour exposure at 170 ppb exposure in Brix study did not show an indication of tissue Se increase.

Bill A. pointed out an apparent disconnection between algae Se concentrations in the University of Wyoming study and Martin Grosell's radio isotope study. Bill W. pointed out that Martin's model seems to predict well and asked if that was just luck. Martin's study shows that the organisms take in the Se and also release Se. Bill A. would like to confirm that the organisms have a similar Se concentration as the lake level to start the experiment with, as well as a stable state analysis. He also said that we need to get Martin's full report to understand the whole picture. Jeff said that we should be getting Martin's draft report shortly; the two progress reports would not change much. Bill A. said that Martin did agree that he had not measured the steady state total concentration and he does not know what concentration he ended up with (i.e., Martin measured the increase in the Se of 0.3 µg/g but did not measure the total [it could be 1.3 or 2.3, we don't know]). Teresa asked whether Bill A. had talked to Dave Buchwalter about Grosell's study regarding Bill A.'s concern. Bill A. said not yet. Jeff said that Dave Buchwalter would receive the draft report from Martin at the same time when Science Panel receives it. Bill A. feels the assimilation rate part of Martin's study is good, but not sure about the uptake or depuration rate. Teresa asked that Dave Buchwalter review Martin's study and provide comments to the Science Panel. Jeff said that we would update the GSL bioaccumulation model if Martin's model is revised.

The Science Panel discussed the algae uptake figure in Martin's second progress report. Jeff asked Bill A. whether the fact that the corixids data he showed are from fresh water has any impact. Bill A. said by looking at selenate, selenite, and organic form of Se, the selenate is not the best form for diet uptake, knowing the assumption that the primary Se uptake by organisms is through diet.

Jeff suggested a conference call with Dave Buchwalter and Martin. Bill A. wanted to take a good look at the report first, get Dave Buchwalter's comments, and then decide what to do the next. Harry suggested having a follow-up action of some analysis on brine shrimp at the stable state and analyzing the end concentration.

Summary of Discussion & Presentation to Steering Committee

Jeff asked the Science Panel to give feedback on what to present to the Steering Committee regarding the bioaccumulation model. The Panel discussed how to best present the model to the Steering Committee in an understandable way. Bill W. stated the mass balance model is for the permit management and the bioaccumulation model is for developing the Se standard. Perhaps it is better to separate the flow chart into two sections and address each individually. It may be better to go in the reverse direction (from eggs or diet back to water) for the bioaccumulation model because the critical endpoints (Se in eggs) are the focal point. Bill M. wanted to provide information to the Steering Committee to help them decide where to set the toxicity threshold for policy decision. The Science Panel needs to be able to make a recommendation to the Steering Committee if the Science Panel identifies a problem. Don said the presentation needs to include what we know and start to lay the ground work, the direction we are going, etc; the decision will be based on water column concentration. Anne suggested first walking through the model and the process; as we go through the process, bring in the project status if needed.

Again, the Panel discussed the order and the depth of details while presenting various topics and content of the model to the Steering Committee. Earl suggested including the reason of a steady-state mass balance model in the presentation, so the Steering Committee understands the complexity. Bill A. suggested giving two extreme scenarios and stating we are working in between these two. Bill M. wants to include the threshold values in the presentation.

Jeff suggested having a special session either in January or February to specifically talk about the threshold value prior to setting the Se standard. Maunsel wants to have the threshold value and EC curve discussion on 11/30 with the Steering Committee. Jeff said that the two-page fact sheet of threshold value is not ready to be handed out on 11/30. Don Hayes emphasized again the responsibility of the Science Panel of putting a wrapper around the box and presenting the information in an understandable way to the Steering Committee.

The Science Panel agreed that Jeff would draft a presentation for the Steering Committee based upon the discussion and present to the Science Panel at 8:00 am the next morning (11/30/2007). The Science Panel would have one hour to review, discuss and approve prior to the Steering Committee meeting.

Proposed Schedule

The Science Panel identified the following schedule for future meetings and conference calls:

12/20/2007, 10 to noon, SP conference call (CHB Room 335)
1/24/2008, 10 to noon SP conference call (CHB Room 336)
2/20 and 2/21/2008 SP meeting (DEQ Room 201)
2/22/2008 Joint meeting (DEQ Room 101)
3/27/2008 10 to noon, SP conference call (CHB Room 336)
4/30 and 5/1/2008 SP meeting (Bill needs to find a conference room.)
5/2/2008 Joint meeting with Steering Committee (Bill needs to find a conference room)